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NASA TECH BRIEF

Marshall Space Flight Center

Method for Constructing Periodic Orbits in Nonlinear Dynamic Systems

The problem:

To devise a method for constructing precisely periodic orbits which, at the beginning, dynamically approximate solutions that converge to precise dynamic solutions in the limit of the sequence. Previous methods isolated orbits with a sequence of precise dynamic solutions which, at the start of the sequence, have only approximate periodicity but which converge to a periodic solution in the limit of the sequence.

The solution:

A computer program that utilizes an iterative method for constructing periodic orbits in nonlinear dynamic systems.

How it's done:

The method used in this program is a modification of the generalized Newton-Raphson algorithm for analyzing two-point boundary problems. This technique is distinct in that it constructs a sequence of precisely periodic, but at the start, dynamically approximate, solutions that converge to a precise dynamic solution in the limit of the sequence. The iterates are solutions of a linear system derived from the dynamic equations of motion. For conservative Hamiltonian systems, stability of the periodic orbit is determined as a by-product of the orbit iterating method. Along the periodic orbit, the trace of the variation equations resolvent (fundamental matrix) uniquely determines the characteristic exponents of the orbit. An approximation to the resolvent along each iterate is determined in the solution of the linear system.

Notes:

1. This program is written in FORTRAN IV for use on the IBM-360, Model 65 computer.
2. This program can be used in calculating periodic orbits in either circular or elliptic restricted three-body problems.
3. Requests for further information may be directed to:

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   Barrow Hall
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   Athens, Georgia 30601
   Reference: B71-10151

Patent status:

No patent action is contemplated by NASA.

Source: A. G. Bennett, J. I. Palmore, and L. M. Hanafy of
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